remainder of the specification. Thus, no new matter is added. As discussed in detail below, claimed subject matter distinguishes patentably over the cited art.

Allowed Claims

Applicants acknowledge with appreciation allowance of claims 12 and 13.

Allowable Claims

The Office Action also deems claims 10 and 11 as allowable if rewritten in independent format to include the features of the claim(s) on which they depend.

Accordingly, claim 10 is rewritten as an independent claim to incorporate the features of claims 8 and 1 on which it depends. Hence, claim 10 is in condition for allowance. Claim 11 depends on claim 10, and is thus in condition for allowance as well.

Rejection Under 35 U.S.C. 112

The Office Action rejects claim 1 as containing subject matter not described in the specification. In particular, the Office Action is understood to reject the amendment of claim 1 introduced in the response to the previous office action in which the phrase "fluid other than molecular oxygen" was amended to recite "fluid other than pure molecular oxygen."

Although Applicants respectfully disagree with the Examiner regarding the lack of support in the specification for this amendment, Applicants amend claim 1 to remove the adjective "pure" from the claim in order to expedite the prosecution of the application. Further, claim 2 is amended to remove "air" from the recited list of the fluids. The amendment of claim 2 is not intended to surrender subject matter regarding the use of air as a background fluid, but is rather introduced to ensure conformity with claim 1 on which claim 2 depends.

In view of the above amendments, the rejection of claim 1 is overcome.

Rejections Under 35 U.S.C. 103

The Office Action rejects claims 1-9 as being obvious in view of the combined teachings of U.S. Patent No. 6,313,014 of Sakaguchi and U.S. Patent No. 6,506,662 of Ogura. The

claimed subject matter distinguishes patentably over the combined teachings of these two patents at least for the following reasons.

The present invention relates generally to methods for SIMOX wafer processing of a silicon substrate that inhibit formation of threading dislocations in the top silicon layer. More particularly, claim 1, as amended, recites a method of processing a silicon substrate that includes evacuating a vacuum chamber in which the substrate is placed to a first pressure, introducing a fluid other than molecular oxygen into the chamber as a *background gas*, and implanting ions into the substrate to form a buried oxide layer under a top silicon layer. The fluid inhibits formation of threading dislocations in the top silicon layer.

As acknowledged by the Examiner, Sakaguchi, which relates to a method of manufacturing an SOI substrate, fails to teach or suggest *implanting* ions in the *substrate* while a background fluid is present in the implantation chamber. Rather, Sakaguchi describes annealing a single-crystal silicon substrate by heat-treating a silicon substrate in a reducing atmosphere containing hydrogen, and in a separate step, forming an ion implantation layer in the substrate by oxygen implantation.

Thus, Sakaguchi fails to teach or suggest material features of the claimed subject matter.

Likewise, Ogura fails to teach or suggest utilizing a background gas *while implanting* ions in a substrate. Ogura, which relates to a method of forming a silicon on insulator substrate, describes generating ions in a plasma chamber through a plasma dissociation process initiated by irradiation of selected gas molecules introduced into the plasma chamber. The ions are then accelerated by a plurality of acceleration electrodes to be introduced into a *separate* reaction chamber in which a silicon substrate is disposed. The accelerated ions then impact the silicon substrate for implantation therein. Ogura does not teach or suggest utilizing a background gas in the reaction chamber while the ions are bombarding the silicon substrate.

The Examiner refers to certain passages in Ogura, namely, col. 3, lines 60-67; col. 4, lines 1-4; col. 8, line 61 to col. 9, line 2; and col. 9, lines 54 –62, to assert that Ogura teaches implanting oxygen atoms in the substrate while a fluid is present. Applicants respectfully

disagree. None of these passages, or in fact any other portion of Ogura, teaches or suggests utilizing a background gas in the reaction chamber while the substrate is implanted with ions.

Rather, the passages in col. 3, lines 60-67 and col. 4, lines 1-4 simply indicate that it is preferable to add a dilution gas, e.g., H_2, He, or Ar, to the gas molecules present in the plasma chamber, *not* in the reaction chamber. Likewise, the passage in col. 8, line 61 to col. 9, line 2 of Ogura relates to dissociation of molecules in the plasma chamber, and not introduction of background gas into the reaction chamber. For example, Ogura recites that by "varying O_2 molecule concentration in the diluted gas, it is possible to set the dissociation conditions in wide ranges..." Finally, the cited passage of col. 9, lines 54-62 refers to annealing silicon-on-insulator substrates produced by Ogura's method in an argon atmosphere including 10% oxygen before their evaluations by transmission electron microscopy. Hence, similar to the other passages, this passage is not directed to utilizing a background gas while *implanting* ions in the substrate.

In sum, Ogura's introduction of various gas molecules to vary plasma dissociation conditions in the plasma chamber is fundamentally different from Applicant's use of a background gas in an implantation chamber while implanting ions in the substrate.

Hence, Ogura's teachings fail to bridge the gap in the teachings of Sakaguchi to render the claimed subject matter obvious.

Accordingly, reconsideration and allowance of claim 1, and claims 2, 6-9 dependent directly or indirectly on claim 1, are respectfully requested.

New Claims

Independent claim 20 recites a method of processing a substrate in which a hydrogen containing fluid is introduced into a vacuum chamber in which the substrate is disposed, and ions are implanted into the substrate while the fluid is present as a background fluid. Support for this claim can be found on page 6, lines 5-10, page 8, lines 4-8, in the original claims (e.g., claim 2), and throughout the remainder of the specification. Thus, no new matter is added.

The arguments presented above with respect to claim 1 apply with equal force to establish that claim 20 is patentable over the cited art. In particular, the combined teachings of the cited references fail to teach implanting ions into a substrate while a hydrogen containing fluid is present in the implantation chamber. Thus, claim 20, and claim 21 that depends on claim 21, are patentable.

Independent claim 22 is directed to a method of processing a silicon substrate that includes introducing a fluid that functions as a reducing agent into a vacuum chamber in which the substrate is disposed, and implanting ions into the substrate while the fluid is present in the implantation chamber as a background gas. Support for this claim can be found on page 8, lines 4-8, page 10, lines 1-8, and page 10, lines 10-15, in the original claims, and throughout the remainder of the specification. Thus, no new matter is added. As discussed in detail above, none of the cited references teaches or suggests implanting ions into a substrate while a background gas is present in the implantation chamber. Thus, claim 22, and claim 23 that depends on claim 22, are patentable over the teachings of the cited art.

Independent claim 24 recites a method of processing a silicon substrate in which a fluid that can function as a surface oxide inhibiting agent is introduced into a vacuum chamber in which the substrate is disposed, and ions are implanted in the substrate while the fluid is present in the chamber. Support for this claim can be found at page 9, line 9 to page 10, line 8, in the original claims and throughout the remainder of the specification. Thus, no new matter is added. The arguments presented above apply with equal force to establish that claim 24, and claim 25 that depends thereon, are patentable over the cited art as well.

CONCLUSION

In view of the above amendments and remarks, Applicants respectfully request reconsideration and allowance of the application. If there are any remaining issues, Applicants invite the Examiner to call the undersigned at (617) 439-2514.

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Respectfully submitted,

By____________________

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LISTING OF PENDING CLAIMS WITH REVISIONS MARKED

1. (currently amended) A method of processing a silicon substrate, comprising:

evacuating a vacuum chamber in which the substrate is placed to a first pressure,

introducing a fluid other than [pure] molecular oxygen into the vacuum chamber as a background fluid, and

implanting ions into the substrate to form a buried oxide layer under a top silicon layer, wherein the fluid inhibits formations of threading dislocations in the top silicon layer for reducing a defect density of the processed substrate.

2. (canceled)

3. (canceled)

4. (canceled)

5. (canceled)

6. (original) The method according to claim 1, wherein the first pressure is less than about $1X10^{-5}$ Torr.

7. (original) The method according to claim 1, wherein introducing the fluid into the vacuum chamber produces a second pressure in the vacuum chamber that is less than about $1X10^{-3}$ Torr.

8. (original) The method according to claim 1, further including actively controlling the amount of fluid introduced into the vacuum chamber based upon a parameter measured in the chamber.

9. (original) The method according to claim 8, further including selecting the parameter from the group consisting of pressure, water vapor/ion concentration, and temperature.

10. (Currently Amended) [The] A method [according to claim 8] of processing a silicon substrate, comprising

evacuating a vacuum chamber in which the substrate is placed to a first pressure,

introducing a fluid other than molecular oxygen into the vaccum chamber as a background fluid,

actively controlling the amount of fluid introduced into the vacuum chamber based upon a parameter measured in the chamber, and

implanting ions into the substrate to form a buried oxide layer under a top silicon layer, wherein the fluid inhibits formations of threading dislocations in the top silicon layer for reducing a defect density of the processed substrate,

wherein the parameter includes a measurement of an ion beam current.

Cont'd

11. (original) The method according to claim 10, wherein the measurement includes a measurement of a decrease in the beam current due to the fluid in the chamber.

12. (previously amended) A method of processing a substrate, comprising:

evacuating a vacuum chamber in which the substrate is placed to a first pressure;
introducing a fluid into the vacuum chamber;
implanting ions into the substrate using an ion beam to form a buried oxide layer under a top silicon layer;
measuring a decrease in the ion beam current level due to the fluid in the chamber; and
adjusting the fluid level based upon the measured ion beam current level.

13. (original) The method according to claim 12, further including the step of selecting the fluid from fluids that inhibit formations of threading dislocations in the top silicon layer for reducing a defect density of the processed substrate.

14. (canceled)
15. (canceled)
16. (canceled)
17. (canceled)
18. (canceled)
19. (canceled)

20. (new) A method of processing a silicon substrate, comprising:

evacuating a vacuum chamber in which the substrate is placed to a first pressure,

introducing a hydrogen containing fluid into the vacuum chamber as a background fluid, and

implanting ions into the substrate to form a buried oxide layer under a top silicon layer, wherein the background fluid inhibits formations of threading dislocations in the top silicon layer for reducing a defect density of the processed substrate.

C'td cont'd

21. (new) A method according to claim 20, further comprising selecting the fluid from the group consisting of water vapor, heavy water, air, and hydrogen gases.

22. (new) A method of processing a silicon substrate, comprising:

evacuating a vacuum chamber in which the substrate is placed to a first pressure,

introducing a fluid functioning as a reducing agent into the vacuum chamber as a background fluid, and

implanting ions into the substrate to form a buried oxide layer under a top silicon layer, wherein the background fluid inhibits formations of threading dislocations in the top silicon layer for reducing a defect density of the processed substrate.

23. (new) A method according to claim 22, further comprising selecting the fluid from the group consisting of hydrogen gases and argon.

24. (new) A method of processing a silicon substrate, comprising:

evacuating a vacuum chamber in which the substrate is placed to a first pressure,

introducing a fluid functioning as a surface oxide inhibiting agent into the vacuum chamber as a background fluid, and

implanting ions into the substrate to form a buried oxide layer under a top silicon layer, wherein the background fluid inhibits formations of threading dislocations in the top silicon layer for reducing a defect density of the processed substrate.

25. (new) The method of claim 24, further comprising selecting said fluid to be hydrogen gases.